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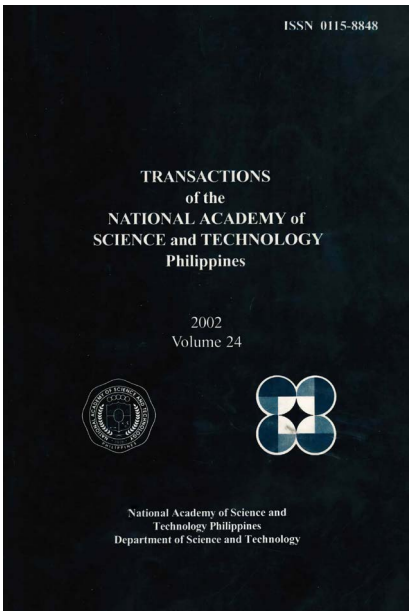

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Miguel Q. Rapatan and Allan B.I. Bernardo

De La Salle University-Manila

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REIMAGINING THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN PHILIPPINE EDUCATIONAL REFORM

MIGUEL Q. RAPATAN and ALLAN B.I. BERNARDO
De La Salle University-Manila

ABSTRACT

Two approaches regarding the role of information and communication technology (ICT) in the reform of Philippine education are compared in this paper. The "transmission" approach assumes that the appropriation of ICT will serve to improve the existing systems and processes of the educational system. In particular, ICT would enable the more efficient and effective transmission of knowledge to students. In contrast, the "transformation" approach assumes that the ICT provides opportunities for transforming the systems and processes of the educational system. For example, the use of ICT can lead to redirection of the teaching-learning processes in ways that change the goals and the nature of the curriculum that redefine the roles of the teacher and the student, and that make the learning and assessment activities more interactive, experiential, and authentic. Examples will be given to illustrate the characteristics of how ICT is used in education according to the two approaches. The paper argues that the transformation approach to ICT use will be more effective in bringing about more effective learning in students, particularly in helping students develop the higher level thinking skills that are required in a knowledge society. Thus, the transformation approach is more likely to produce graduates who will be more competitive and who can more effectively navigate the emerging global labor markets.

Keywords: ICT, educational reform, transformation, transmission

Many sectors of the Philippine education community seem to hold the opinion that information and communication technology is a potentially important resource for addressing the various problem if Philippine education. For example, as early as 1996 the Department of Education DECS launched the Computerization Program that seeks to distribute personal computers to all the public high schools in the country. More recently, a more ambitious government projects was launched. This

project, "PCs for public schools" aims to establish 1,000 computer laboratories in 16 regions in the country. Similar projects are being undertaken by other government agencies like the DOST and the DTI. This program seems to be premised on the notion that having computers in public high schools is an important step towards realizing the lofty goals of Philippine education.

The private sector has also joined in this effort. For example, in support of the DepEd Computerization Progam, the Personal Computers for Public Schools (PCPS) project targets to reduce the computer backlog in public high schools over the next three years. It also aims to integrate computer education in the public secondary schools system, raise the computer literacy levels of teachers and students by providing them access to computer and information technology, and equip students with the necessary skills and competencies to prepare them for IT-related college work and employment. The private sector seems to be joining in this effort as they see ICT-related skills as being essential skills in the workforce of the future.

It is not surprising that many efforts in line with harnessing the resource of ICT for educational reform are directed towards improving the ICT-related skills of teachers. The most recent CHED Memo relating to the Pre-service Teacher Education Curriculum made in mandatory for all teacher education graduates to complete a minimum of three units on education technology, a course that includes use of ICT in education. The DepEd and the DOST have also sponsored numerous In-Service Teacher Education programs to ensure that the teachers already in service will be able to acquire the necessary ICT-related skills. As teachers are very potent agents in the education process, these efforts are directed at insuring that they will be capable and effective agents in the use of ICT in improving education.

The expectations regarding the positive effects of ICT in Philippine education seem great, and the resources being invested on the various ICT-related education programs are just as intensive. But are these expectations reasonable? Are these investments being wisely made? To state these questions more precisely: Does the use of ICT truly lead to better learning of students in schools? Does the adoption of ICT actually make teachers and schools more effective agents of learning and development? Does the integration of ICT in the curriculum effectively prepare the future workforce for the demands of the globalized labor and economic market? The answer to such questions depends on how we understand, approach, and plan the role of ICT in Philippine educational reform.

In this paper, we consider two broad approaches to the use of ICT in education, which we shall refer to as the transmission model and the transformation model. We will contrast the assumptions of these two models and give exemplars for these two models. We shall then consider the likely consequences of adopting either model. We shall consider the consequences for teaching and student learning in the classrooms, and for developing requisite skills for the labor market. We shall then make a brief assessment of Philippine efforts related to the use of ICT in education and recommend that efforts be realigned to be more consistent with the transformation models.

UNDERSTANDING ICT IN EDUCATION

Synergy between Cognition, Pedagogy, and Technology

We would like to begin our presentation with the premise that the question of effective ICT integration is basically a question of pedagogy and one's articulation of students' cognitive processes. In other words, the dominant thinking among the school's faculty of how students learn and the concomitant pedagogical practices embodying such beliefs will define the faculty and students' use of ICT resources. In an e-learning setting where ICT plays a pivotal role, the relationship of beliefs and practices with technology may be diagrammed as follows (Fig 1):

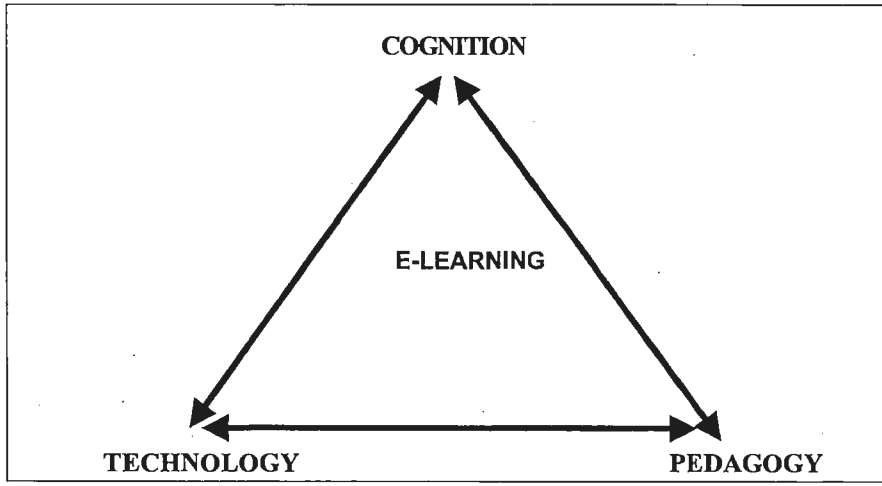

Figure 1. Framework for E-Learning

In this framework, the student's e-learning experience involves the development of his or her cognition through the use of particular pedagogies and information and communication technologies. Cognition occupies the apex or end goal of technology and pedagogy because this is the goal of e-learning. By cognition, we mean the student's ability to produce knowledge not just in its intellectual form but also in its multiple dimensions involving affect and psychomotor domains. Technology and pedagogy are at the service of the student's cognition. As Duffy and Jonassen (1992) note, "theories of learning and prescriptions for practice must go hand in hand." Technology refers to the system and tools educators use while pedagogy encompasses the educators' beliefs about and practices related to learning. Teachers employ specific technologies and enact particular pedagogies for the purpose of developing the students' cognition. The interaction of technology and pedagogy is then viewed as bidirectional. Similarly, the action of technology

and pedagogy on the student's cognition is not meant to be unidirectional. Genuine cognitive growth results when the students participate in the selection of technology and propose alternative pedagogical settings and procedures.

For many years now, instructional designers who have sought to integrate ICT in the school curriculum have interpreted the relationship of cognition, pedagogy and technology in two major models in dialectical opposition to each other. To understand these differences, let us consider two scenarios which illustrate common usages of multimedia technology for classroom instruction.

E-learning Scenarios

In Scenario A, situated in a highly wired urban grade school, a teacher begins her class by bringing her students to the computer lab and telling them that they will be using Encarta, Microsoft's popular encyclopedic CD-ROM. Some of the students clap and the teacher sees that most of the students are excited to work with an online reference material. The teacher first talks about the topic of Flood Control and then conducts a short discussion with the students about their ideas on the lesson. The students are able to answer because they read in advance as part of their assignment an article in their textbook about the topic. When the teacher finds that the students are ready to work with Encarta, she shows them a Powerpoint slide which has the following instructions. The teacher asks the students to locate in Encarta the causes and effects of floods and suggest measures to control floods. (These same topics are also discussed in the textbook article.) The students then click on the program on their desktops and begin to work.

In Scenario B, this time in another grade school located in a busy major provincial town, a small class of students are studying a similar topic but in a different way. For several days, students interviewed the local meteorologist and compiled records regarding the overflow of the town's primary river. On this particular morning, the teacher has gathered the students in the computer lab and has asked them to enter their data in Excel. The teacher shows a Powerpoint slide with the following instructions. The teacher asks the students to note patterns in the data, make graphs of the data, and make several inferences and predictions from the data about flood control. The students work in groups and run their data through the spreadsheet program. They record the results and discuss their answers to the questions.

In both scenarios, the teachers notice that for the next twenty minutes or so, the students are visibly engaged in their task. In Scenario A, the teacher sees the students actively following the links to the topic she selected. In Scenario B, the teacher finds the students busy interpreting the data. Although students in both scenarios display a high interest in the topic, such an attention level does not necessarily guarantee that their use of the technology is generating significant learning outcomes. How then can one tell in which scenario ICT was used in a meaningful way?

An application of our proposed framework can. help us answer this question. In Scenario A, the teacher wanted her students to search for passages in Encarta which answered her question. A cursory comparison of the Encarta passages with the textbook article shows that the content is not very different. Except for a few short film clips in Encarta, the discussion of the lesson is practically the same. Although the teacher may have used Encarta's movie clips about flood prevention to help the students visualize the lesson's main ideas, her objective in the end was to have the students identify the passages relevant to her question. In terms of pedagogy, the teacher wanted students to identify content and not reflect about it or relate to their daily life experience. Being content-centered, the teacher used the CD-ROM as a source of information for the students. As a result, the students simply received content presented in an attractive way. But they did not produce any new knowledge since they were only asked to spot and read pertinent sections.

Transmission Model

This style of technology integration may be called the transmission model (Fig 2). In this model, the pedagogical setting is largely teacher-directed. The teacher views cognition as a process of reception where students accept a body of truths which remains valid and consistent regardless of social circumstances. The teacher is chiefly concerned with covering the curriculum and communicating its content. The teacher relies on his or her wealth of knowledge and experience to convey the content and assumes that the students have little or no understanding at all of the subject. The teacher positions himself or herself as the content expert, much like the "sage on the stage." If the teacher uses technology, he or she will treat technology as a medium of dissemination of content. Technology is viewed as an extension of the book or blackboard. Technology is also considered like a "hypodermic" needle which is capable of injecting content to the minds of the ignorant learners. Using our framework, one can diagram this model as:

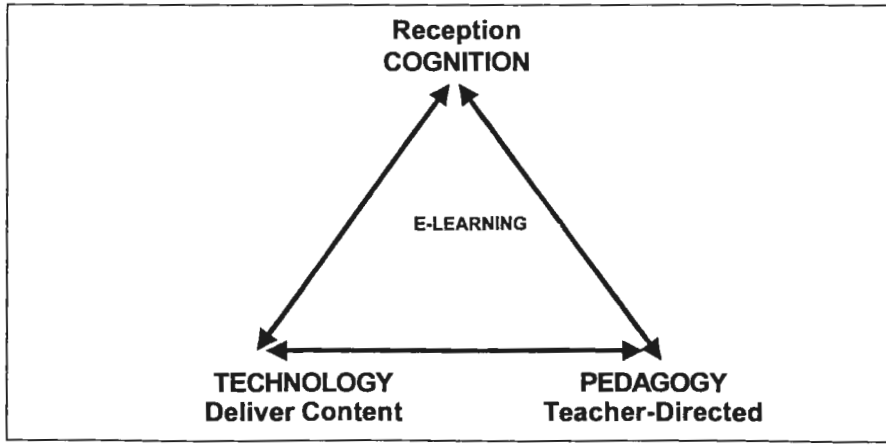

Figure 2. Transmission Model of E-Learning

A closer look at this model will also show that the teacher's overriding concern for content delivery practically diminishes or renders invisible the technology's interactive and feedback features. One can go on to say that the technology does not make a substantial change in the learning process. In Scenario A, the teacher could have conducted the lesson without the CD-ROM and the students could still get the same content.

Transformation Model

In contrast to this, the students in Scenario B are encouraged to work together to solve the problems posed by the teacher. The teacher spends minimal time lecturing to the students and instead, goes around the room listening to the various group discussions. The teacher pays great attention to how students are thinking and discussing. The teacher places the students at the center of the class. At certain times, like a "guide on the side" the teacher will interject her comments or questions about the direction of the students' work. The teacher asks students to consider reviewing their interpretation of the data by pointing out certain discrepancies and having the students validate their initial ideas with the use of the computer.

In this scenario, the teacher relies on the students' prior knowledge about the topic. She has structured the class in such a way that throughout the period, the students will interact with various resources (i.e., his or her peers, real life data, spreadsheet program) in order to examine this prior knowledge. For her, cognition is a process of reflection on one's initial or stock concepts which then leads to an application of the ideas in real life situations. Unlike the behaviorists who treat students as empty vessels, the teacher adopts a constructivist stance by having students examine and change their naive concepts which is part of their prior knowledge. Students then talk about the output and more importantly, the process they undertake during their work. Students think about the flow of their thinking; i.e., how an idea led into another, the difficult parts, the ways they sorted out the confusing parts, or the alternative insights they considered. Students articulate how they would transfer their problem-solving strategies to various situations.

In the end, the prior knowledge is transformed. A conceptual change occurs which is then stored in long-term memory. In this way, students become independent learners equipped with a repertoire of flexible and resourceful thinking strategies. Because they have been trained to think with problems, students are able to do multitasking and synthesize data from different resources. The teacher realizes that for these outcomes to occur, students must be helped with tools to assist them in their change of thinking and building of concepts. For the teacher, technology is a tool for transforming thinking. We can then diagram this e-learning scenario as: (Fig. 3)

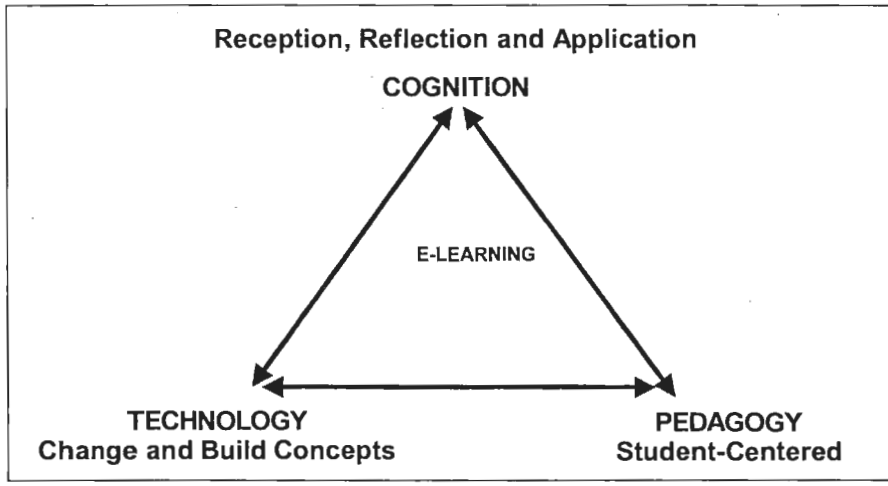

Figure 3. Transformation Model of E-Learning

The transformation model then goes beyond having the students merely receive information. Cognitive growth occurs when the students interpret and organize received information to a particular conceptual structure that integrates their reflection about the concepts' nuances and levels of meaning and their relationship with daily life experiences. With ICT, students are able to identify the gaps and errors in their concepts and find different ways of acquiring the proper concepts and skills.

The Two Models and Their Consequences

In this section, we first consider how the two models of ICT in education might effectively reform educational processes and systems, particularly those that relate to learning and teaching in classrooms. Then we consider how these models relate to larger education-related goals beyond the classroom.

More than radio, movies, and television, ICT seem to be poised to have a more substantial transforming effect on higher education pedagogy. This is because as Harvard University President, Neil Rudenstine (1996) argued,

> *"there is in fact a very close fit - a critical interlock - between the structures and the processes of the Internet, and the main structures and processes of university teaching and learning. That same fit simply did not (and does not) exist with radio, film, or television ... Students can carry forward their work on the Internet in ways that are similar to - and tightly intertwined with - the traditional ways that they study and learn in libraries, classrooms, lecture halls, seminars, informal discussion groups, laboratories, and in the writing and editing of papers or reports."*

Rudenstine further argues that the Internet is a very powerful tool for learning in the same way that research libraries are and for the same reasons. Libraries and the Internet are proving to be important versatile systems that will be truly powerful if used together towards a particular educational function. This is true whether one is talking about a student doing research for a term paper, or a faculty member preparing a course syllabus and teaching materials, or a university researcher working on a basic disciplinal research project. Thus we can expect that the Internet and other information technologies may be more easily assimilated into the existing processes and practices in education institutions, yet they will be amplifying and transforming the existing practices when this assimilation is fully realized.

Changes in the Goals and Process of Education

Using the transmission model, we can anticipate that the basic teacher-centered pedagogies and other related processes will be enhanced with the infusion of more sophisticated technologies. The new ICT is most certainly a more vivid and engaging medium and would thus effectively increase the attention of learners in the classroom. This is an important factor in a teacher-directed learning environment, and thus we can expect reasonable gains in learning with the use of ICT. The use of ICT for representation of knowledge can also ensure that information that is presented and demonstrated is accurate and effectively transmitted or broadcast. The use of ICT can also theoretically improve access to education by way of creating alternative modes of delivering educational services. We say "theoretically" because certain minimum requirements need to be fulfilled related to the infrastructure in order to attain this important consequences. These varied effects actually take the form of enhancing and amplifying the traditional activities being practiced in many classrooms.

Using the transformation model, we can anticipate a more varied and significant set of consequences. We can anticipate more direct changes in the processes of higher education, particularly in the instructional processes of higher education institutions. The creative use of ICT can also change the very goals of educational processes. For example, Seymour Papert (1980; 1994) proposed rather radical changes in how schools should be organized, and his proposals revolved around the critical introduction of the Logo programming language to school children to allow them to achieve deeper levels of understanding. Recent research suggests that actual educational programs using Logo do not actually lead to improved learning (see e.g., O'Shea, 1997; Pea & Kurland; 1984). However, recent technology seems to be transforming educational processes in less radical but in some more significant ways. In school systems that have incorporated the use of scientific and programmable calculators and computers in mathematics classrooms (e.g., the United States and Japan), the emphasis of the mathematics curriculum was changed from paper and pencil calculation to mathematical problem solving and modeling (Black & Atkin, 1996). Indeed, the new technologies seem to be quite potent in allowing today's students achieve new and higher goals of learning (see e.g., Crook,

1994; Means, 1996b; Vosniadou et al, 1996; Underwood & Underwood, 1990). Moreover, teachers who become very comfortable in using specific types of technologies in their classes might feel more empowered to try new applications and take make more departures from set curricula and instructional methods, and in effect begin altering the specific goals of instruction (Herman, 1996).

Changes in the Role of Teachers

Another way by which ICT may directly alter educational processes is in its impact on the delineation and definition of teacher and student roles in learning (Barren & Goldman, 1996; Rudenstine, 1996). Information technology makes information so accessible so much so that the teacher is no longer the privileged fountain of knowledge in the classroom. Indeed, it may often be the case that resourceful and energetic students will have access to information that the teacher does not have. This may lead to a shift from the perspective of the teacher as the authoritative transmitter of knowledge and the student as passive receiver of knowledge. Teachers need to rethink their roles not as the "sage on the stage" but as "the guide on the side." Like a coach, the teacher poses significant questions so that students can comment on their work and make intelligent judgments about their own decisions and assess the information they access.

Changes in the Role of Students

More importantly, the available ICT allow for more independent and active learning on the part of the students (Means, 1996a; Rudenstine, 1996). In the Internet, students can act and perform as if they were actual scholars. That is, they can ask and pursue their own questions, search for the information relevant to their questions, consult and discuss with informed others, and proceed in his or her chosen manner of investigation and study (Barren & Goldman, 1996). With such self-directed learners, the role of the teacher is transformed. Faculty members would now be tasked to draw out these learning processes from the students and to guide them towards desirable learning goals.

Thus, teachers will need to design and structure learning environments and activities that will allow students to control and maximize their own learnings. The emerging role of the teacher then is as a designer of thinking environments. Teachers will strive to find ways of helping students be more reflective and move them from being consumers of information to producers of knowledge.

In these environments, texts and readings need no longer be treated as canonical or authoritative. Instead, readings will need to be chosen and sequenced by the faculty members in ways that will allow the students to explore arguments and counterarguments in their own specific processes (Rudenstine, 1996).

Teachers will also have to be trained on how to use technology to support this approach. For these thinking environments, teachers will treat technology not as a stimuli (as it is for the behaviorists) or a mirror of the mind (as treated by the

cognitivists). Teachers will use technology as a "mind tool" which enables students to observe, critique and present the way they think.

Changes in the Curriculum

It is also conceivable that curricula might have to be revised in terms of the knowledge and skills that will be targeted for development. It is likely that factual knowledge and basic data will no longer be as important for two important reasons. First, most of the facts and data will most likely be changed or proven wrong sooner than expected. It will be increasingly difficult to speak of a fixed core knowledge or of a canon of works in a field. Second and more important, most of the facts and data that students will need to know in the execution of the job functions will most likely be available in technology-based information sources like the Internet. Rather than knowledge of facts and data, the need will be for training on how to learn. Salmi refers to these as "methodological knowledge and skills" or knowledge and skills related to being able to learn on one's own, being able to source, access, and apply knowledge to each emergent problem situation. Emphasis will be on domain-general skills such as data gathering and analysis, critical thinking, reasoning, argumentation, problem solving and decision making. Being able to work with groups or in teams, being creative, resourceful, flexible, and adaptable are also skills that will be more and more valuable in the near future, and will thus need to be embodied in curricula. Not incidentally, the development of such skills can be achieved by utilizing a variety of modalities and materials like through self-directed text learning, audio-, broadcast-, and digital-technologies, or a combination of these various ICT.

Still regarding the curriculum, there might be a stronger push to shift from a prescriptive curriculum to a more elective curriculum. Prescriptive curricula specify what courses students ought to take and when. Elective curricula, on the other hand, allow the students to determine the specific parts of the curricular program. It seems to us that a prescriptive curriculum will not be responsive to the diverse character and training needs of the emergent student body. The fast developments in the various fields will also make it difficult to truly fix what students should know at one point in time. Indeed, it is probably virtually impossible to cover all the important information in one discipline in the regular span of college education. The students ought to be allowed to design some part of the curriculum by selecting sub-areas within the broad domains of knowledge in ways that will best fit his or her educational objectives. Thus it seems, that at some level, more student input in the curriculum might be necessary.

Beyond the Classroom: ICT in Developing the Future Workforce

These forces that are shaping the future environment for higher education are changing the training requirements for the labor force or the human resource base. In highly competitive, knowledge-based economies the labor force needs to

develop higher level knowledge and skills. But at the same time, since economies are changing rapidly, and the technologies utilized in the different work environments are also being replaced just as rapidly, there is a strong requirement for continuous updating of knowledge and skills (Jurich, 2000b; Salmi, 2000). Lifelong education and lifelong learning are not merely buzzwords, they are necessary reconstructions of basic educational assumptions to suit the requirements of the present globalized environment. Moreover, a more diverse set of individuals will seek training in higher education institutions. One would also expect that the clientele of HEI's would no longer be mostly composed of high school graduates engaged in full-time undergraduate study. The clients of HEI's will be much more diverse in age, some may be working full time or part time, some may be studying only at night time or during weekends, and so on (Jurich, 2000b).

There is no doubt that these curriculum changes will have a strong impact on the quality of the workforce we intend to develop for our economy. As the world rapidly shifts to a knowledge-based economy, we will need workers who have the mindset and skills to use ICT in creative ways. We should not simply have a large proportion of our ICT manpower act as a resource geared to servicing outsourced contracts for overseas backroom operations like data encoding, processing and conversion and records and systems management for software and assembly and fabrication of imported templates, parts, boards, and drives for hardware units. We need to reconceptualize the ICT worker as a knowledge professional who is a creative and original thinker and can demonstrate more advanced skills in product design and innovation or development of breakthrough technologies such as new operating systems and compilers or "killer applications." With these knowledge professionals, the country can reverse the flow of dependence by the local economy on multinational ICT enterprises and create conditions where foreign companies adopt our own systems. Knowledge professionals can empower the country to be more self-reliant by carving new niche industries with indigenous proprietary technologies featuring radical and better alternatives to current computing processes.

Schools and universities have a principal role in producing these knowledge professionals. For these knowledge professionals to emerge, a culture of learning must be established which will direct the faculty to undertake a paradigm shift in their thinking about learning and use ICT in the classroom and
for distance education in a transformative way.

The Philippine Situation: Transmission or Transformation?

A comparison of the two models suggests that learning outcomes are more stable and enduring in the transformation rather than the transmission model. Researchers ask in what settings do students display activities associated with critical and independent thinking. With this as the criteria, several researches (Wilson, 1996; Tergan, 1997) show that 1) behaviorist designs in the transmission model result in recall tasks and in varying levels of achievement from low to high; and 2) students using technology in a constructivist mode under the transformation model

demonstrate a deeper level of engagement with the learning task and more elaborate and independent thinking than those working in a behaviorist context.

Although research shows that the direction teachers should take is towards a transformation model of e-learning, some studies have shown that many teachers who have access to programs similar to the ones we have mentioned have not used the technologies for this purpose. Needless to say, many IT schools or education schools in the country have not adequately trained their students to design programs for the transformation model. Many programs are still based on the transmission model.

For example, a review was conducted of 23 graduate researches in the Philippines from 1976-1999 on the use of educational multimedia for classroom teaching. The study covered 23 masteral theses and doctoral dissertations done mostly by students in Metro Manila. Most of these works indicated the use of technology within the transmission model (Rapatan, 2000). The programs contained sections where students read a short explanation and then were asked to respond to multiple-choice type questions and given feedback about their responses. The students were not asked to reflect on how they came up with their computations or solutions. Although some of the programs used authoring tools that could run simulations or collaborative dialogue and other knowledge generation type of activities, very few of the programs or the total instructional system had these features. In some software, the content duplicated the lessons in the textbook. Pedagogically speaking, there was no qualitative difference or value added in using the computer application. Like the teacher in Scenario A, teachers made the computer work like it was an electronic version of the book or blackboard.

Thus, although the expectations and the rhetoric seems to be very progressive, the reality is that the current usage of ICT in Philippine education does not afford more substantive and significant transformations needed for meaningful education reform.

This style of ICT use is not true only for our country. Even in a hi-tech country like the United States, some surveys like those reported or done by Healy (1999) and Manoucherhri (1999) have shown that when teachers were asked which type of software they often utilized, their answer was "drill and practice." This situation shows that teachers can undermine the transformational features of certain multimedia programs by treating them only as media for transmission of content.

This view is particularly persistent in Asian cultures such as in Confucian societies where teachers are accorded a high place of honor. In this article, "It's True. Asians Can't Think" written by an Asian (Shaw, 1999), the author decries the situation where the Asian tends to think that there is one correct answer, only the teacher has the correct answer, and questioning the teacher is disrespectful. Some countries have realized these cultural values must be re-examined if schools have to become learning organizations in order to contribute to a knowledge-based economy. For example, let us look at Hong Kong. In spite of its sophisticated digital infrastructure, Hong Kong educators realize that adherence to Confucian

values may inhibit divergent thinking styles and approaches. In a recent profile by Chung (1999) for *Asiaweek* on Hong Kong and its educational system, many officials in the Ministry of Education bemoan the fact that "most graduates are like robots - afraid to ask questions, admit errors, question decisions... A consensus is emerging on what kind of graduates the city needs (as it moves beyond a service economy into a more knowledge-based one): creative ones, people who can think for themselves, come up with new solutions - the mental ingredients required to fulfill the government's dream of building a high-tech powerhouse" (52).

CONCLUSION

In conclusion, our discussion has shown that our idealized expectations of what ICT can do for our teachers and students requires a great deal of work. Our achievement of technologically-supported educational reforms can begin well with our re-imagination of the use of ICT use from a transmission to a transformation model. As a poet once said, it is only when the image is new that the world becomes new. May our re-imagining of technology bring in a reordering of pedagogy and learning.

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